



**Design**      **TCEC**  
**Engineer**    **Reviewer**

**II. Sanitary Sewer**

1)	Checked Master Sanitary Plan for necessary improvements to serve adjoining property		
2)	Checked existing invert at new connections		
3)	Proposed Sewer Location:		
	a. For street R.O.W.: according to schedule in land development regulations		
	b. For Easements: min. 2' off property or R.O.W. line in middle third of width		
	c. 10' min. horizontal separation between adjacent utilities		
	d. Min. 18" clearance with storm sewer and water main at crossings		
	e. Location dimensions shown		
4)	Manholes (assign number to each): Located at end of line and at all changes of grade, direction, or pipe size		
	a. Size: minimum of 4' diameter		
	b. Maximum spacing: 350' for 8"- 21" pipe and 400' for 24" pipe and larger		
	c. Provide interior drop connections (in a 5' manhole) when inverts are over 18" apart		
5)	Minimum 10" diameter shown for public sanitary sewer		
6)	Types of Pipe: Up to 15" – ABS or PVC Truss Pipe; 18" and larger – C-76, CL IV concrete pipe		
7)	Depth: Minimum of 9' from T/C (or road centerline) to top of pipe unless limited by receiving sewer		
	Slope: Sufficient to provide at least 2 fps velocity such as:		
8)	8" @ 0.40% (0.68 cfs)      15" @ 0.15% (2.60 cfs) 10" @ 0.30% (1.10 cfs)      18" @ 0.12% (3.65 cfs) 12" @ 0.22% (1.57 cfs)      21" @ 0.10% (5.00 cfs)		
9)	For profile:		
	a. Match 0.8' diameter points and drop invert additional 0.10' at 45° turns		
	b. All crossing underground utilities shown (existing or proposed)		
	c. Show: size, slope, and type of pipe; sewer invert and rim elevations		
	d. Show sump-manhole and temporary bulkhead for sewer testing		
10)	Building Service Connections Show:		
	a. Location (shown in center of lot) and sizes shown		
	b. All except industrial: min. 6" PVC SCHED40 or SDR 23.5 pipe		
	c. Zoned Industrial: min 8" PVC SDR26 pipe lead w/ Inspection Manhole		
	d. One lead shown for each unit to be served by public sewer		
	e. Leads clear storm sewer and water main		

**II. Sanitary Sewer (continued)**

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11)	State Construction Permit Submittal:		
	a. Quantities and description of improvements of public sanitary sewer		
	b. Basis of design provided with current and future service populations and flows (Average and Peak flows) shown separately		
	c. Service district map provided with current and future service areas labeled with acreage		
	d. Peak flow calculated with the following formula: Peak Flow = $[(18+\sqrt{TP})/(4+\sqrt{TP})] \times \text{Avg. Flow}$ where TP = (pop.)/1000		
	e. Permit application completed		
12)	20' minimum easements shown for all proposed public sanitary sewer (can be reduced to 12' if adjacent and parallel to a public street)		
13)	City's Standard Detail Sheet with construction notes provided		
14)	Special backfill shown and labeled on plan and profile views where utilities are under the influence of pavement (including sanitary leads)		
15)	Provide casing detail with size (if applicable)		

**III. Water Main (continued)**

**Design Engineer**      **TCEC Reviewer**

1)	Checked Water Main Master Plan for necessary improvements to serve adjoining property		
2)	Water main stubbed at the end of all stub streets		
3)	Min. 2 water main supplies to serve each residential development having more than 30 living units		
4)	Connection to existing main with TSV & Well unless otherwise previously approved		
5)	Proposed Water Main Location:		
	a. For street R.O.W.: according to schedule in land development regulations		
	b. For Easements: min. 2' off property or R.O.W. line in middle third of width		
	c. 10' min. horizontal separation between adjacent utilities		
	d. Min. 18" clearance with storm and sanitary sewers at crossings		
	e. Location dimensions shown		
6)	Hydrants: (Locations are subject to Fire Marshal approval)		
	a. Spacing: Maximum of 500' residential, 300' everywhere else		
	b. Location: Min. 5' from driveways and intersections, 30' from buildings and at the lot line within subdivisions		
	c. Finish grade and location dimensions shown		
7)	Gate Valves and Wells:		
	a. Spacing: 800' maximum, not more than 30 units disconnected when closing sections, not more than 4 gate valves to close off section		
	b. Location: About 5' from R.O.W. intersection and outside of pavement		
	c. Gate well size: Minimum 5' diameter		
	d. Finish grade for gate well rims and size of valve shown		
8)	A gate valve and hydrant provided at the end of all water main stubs		
9)	For Cul-de-Sacs:		
	a. Water main extended around Cul-de-Sac far enough to serve all lots (A bore for water services cannot be more than 28 feet)		
	b. Water main minimum 5' from back of curb		

**III. Water Main (continued)**

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10)	Water Services:		
	a. Min. 1" Copper Service		
	b. Location for each lot shown on plans (4' from property line within subs.)		
	c. Min. 4' separation between water services at connection to public main		
	d. Stop box location shown		
	e. Fire suppression line shown w/GV&W at connection to main (Fire Marshal to approve size)		
	f. Provide the following note on the plans: If basements are involved, all Water Main Service Leads shall be pretapped prior to basement excavation		
11)	Water mains on quarter section lines are 12" minimum diameter		
12)	Public water main, other than hydrant leads, are 8" minimum diameter CL54 DI pipe. Hyd. leads longer than 100' are 8" min. diameter. Size and material type listed		
13)	Water main within 150' of cathodically protected gas main is C900, PVC pipe		
14)	Water main serving Industrial sites are minimum 12" min. diameter		
15)	For all river and county drain crossings, a detailed section with elevations below river and drain bottom shown		
16)	All bends are 45° or less (no 90° bends)		
17)	State Construction Permit Submittal:		
	a. Quantities & description of improvements of public water main shown		
	b. Basis of design provided with initial and ultimate service populations and flows (Average and Max Day) shown separately		
	c. Service district map provided with current and future service areas labeled with acreage		
	d. Nearby existing hydrant flow & pressure test data obtained		
	e. Permit application completed		
18)	12' minimum easement shown for all public water mains		
19)	Standard Detail Sheet with construction notes provided		
20)	Special backfill shown and labeled in plan view where water main is under the influence of pavement		
21)	Provide casing detail with size (if applicable)		

**IV. Storm Sewer**

**Design Engineer**      **TCEC Reviewer**

1)	Master Plan Review:		
	a. Drainage District at receiving sewer defined		
	b. Capacity provided for upstream areas		
	c. Invert at connection verified		
2)	Minimum 4' diameter catch basins (with 2' min. sumps) at low points provided		
3)	Intercepting catch basins so there is not more than 150' of drainage around curb returns provided		
4)	Storm sewer design:		
	a. Design calculations provided based on 10-year storm ( $I = 175 / (25 + T)$ ); used the following imperviousness factors for zoning classification: (a) Single family = 0.35; (b) Multiple family = 0.55; (c) Industrial = 0.80; (d) Commercial = 0.90		
	b. Drainage District map provided		
	c. $Q$ (provided) $\geq$ $Q$ (required)		
	d. HGL minimum 1' below rims of all drainage structures		
5)	Storm sewer size and type:		
	a. Minimum 12" for surface drainage, 8" allowed if only serving sump-pump connections		
	b. Sized as required by calculations		
	c. Use class of RCP pipe necessary for depth		
	d. Roof leads under the influence of pavement are 6" SDR 23.5 (or 8" truss pipe) and clearly labeled as roof drains		
	e. Premium joint pipe provided for sewers in side yards between lots		
6)	Sump pump connections to storm sewer structures shown for each lot		
7)	Sewer Profiles:		
	a. At least 3' of cover shown; Matched 0.8' points at pipe size changes and an additional 0.1' drop at 90° turns		
	b. Hydraulic gradient shown at least one foot below profile's finish grade		
	c. Show all crossing underground utilities (existing or proposed)		
	d. Provide sufficient slope to get at least 2.5 fps velocity 12" @ .30, 15" @ .225, 18" @ .175, 21" @ .14, etc.		
	e. Show: size, slope, and type of pipe, sewer inverts and rim elevations at manholes		

**IV. Storm Sewer (continued)**

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8)	Storm Sewer Location:		
	a. For street R.O.W.: according to schedule in Land Development Regulations		
	b. For Easements: min. 2' off property or R.O.W. line in middle third of width		
	c. 10' min. horizontal separation between adjacent utilities		
	d. Location dimensions shown		
	e. Each lot within the sub has access to a rear yard structure		
9)	Storm sewer manholes (assign number to each)		
	a. Location: at end of line and at all changes of grade, direction, and/or pipe size		
	b. Size: Minimum 4' diameter		
	c. Spacing: (12" - 30") max 350', (36" - 42") max. 400', (48" - 60") max 500', (66" and larger) max. 600' spacing		
10)	2' Storm sewer inlets: discharge into a structure with a sump that is less than 75' away (inlets shall not be used in County ROW's or in rear yards)		
11)	No more than three catch basins shall drain into any one catch basin		
12)	Easement Size: 12' min for sewers 21" and under, 20' for sewers 24"- 48", and 30' for sewers over 48" in diameter		
13)	Sewers located within middle third of easement		
14)	City's Standard Detail Sheet attached to plans		
15)	Special backfill shown and labeled on plan view storm sewer is under the influence of pavement		
16)	Drain enclosures extended 10'-20' beyond R.O.W. to accommodate sidewalks		
17)	Storm Water Detention Basin (If restricted outlet is required)		
	a. Detention provided Basins shall meet current Oakland County Stormwater Standards; Calculations provided		
	b. The basin discharges in 48 hours (calculations provided)		
	c. The basin is completely fenced – 6' chain link fence with double-opening access gate at least 12' wide (no fence needed if 1 on 6 or less slope and pond depth less than 3')		
	d. A 16' wide hard surfaced access road provided		
	e. 1 on 4 side slope minimum, at least 4' distance from the fence enclosure or property line		
	f. A cross section of the basin provided		
	g. For dry basins, the bottom of basin has a min. 1% cross slope to the gutter line. The slope of the gutter line to the outlet shall be a minimum of 0.5%		

**IV. Storm Sewer (continued)**

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	h. Concrete rip-rap provided at all pipe entrances to the basin		
	i. Flared end sections provided at the end of all pipes entering/leaving the basin		
	j. An overflow system with a pipe invert at the design storage level elevation or a concrete spillway with an invert 0.5' above the design storage elevation provided		
	k. For basins with pumped outlets, a silt trap and bar screen is shown on the inlet pipe to the pump station – max. screen clear opening is 2" if permanent water surface is provided, inlet is completely submerged.		
	l. Pump stations used for dewatering include duplex pumps with each pump being able to handle the design 48 hour discharge and separate valve chamber. Both designed according to City standards.		
	m. The starting HGL for storm sewer system is the greater of:		
	1) the 2/3 depth elevation of the design retention basin volume		
	2) the highest 0.8' diameter point elevation of the basin inlet pipe(s)		
	n. The lowest catch basin rim grade is greater than the design water surface elevation of the retention basin and at least 1' higher than the HGL.		
	o. For basins serving multiple sites, easement provided for entire basin area including access drives and pump stations		
	p. Appropriate maintenance agreement, restrictive deeds & covenants, etc. provided for basin maintenance		

**V. Paving and Grading**

**Design Engineer**      **TCEC Reviewer**

1)	Existing and proposed flood plain contour lines, with elevation, shown on all grading plans		
2)	Drainage from entire site is contained on-site.		
3)	Drainage from adjacent sites which flows onto subject site is provided for in site grading / drainage		
4)	Existing grades are matched at the property lines of the site or off-site grading easements obtained		
5)	Entrance detail provided showing all paving, grading, drainage and utility information		
6)	Profiles shown for all public and private roads		
7)	Edge/under drains provided along entire length of public and private roads and/or at low point catch basins in parking lots		
8)	Integral sidewalk and curb detail shown if applicable (18" footing)		
9)	Pavement Grading:		
	a. Concrete:		
	1) Cross slope: Minimum 1%, Maximum 7% (HC areas max 2%)		
	2) Gutter: Minimum 0.5%, Maximum 7%		
	b. Bituminous:		
	1) Cross slope: Minimum 2%, Maximum 6% (HC areas max 2%)		
	2) Gutter: Minimum 0.5%, Maximum 6%		
	c. Drainage arrows provided		
10)	Vertical curve provided, if grade change exceeds 2% (roads only)		
11)	Minimum 1% drop provided around curb returns		
12)	Intersection and Cul-de-Sac details provided (elevations, dimensions and drainage scheme)		
13)	Centerline curve data shown (roads only)		
14)	Stationing left to right shown (roads only)		
15)	Top-of-curb elevations shown		
16)	Commercial Pavement:		
	a. Minimum 8" concrete over 6" of 21 A crushed limestone aggregate		
	b. Minimum 8" bituminous over 6" of 21AA crushed limestone aggregate		
	b. 6" concrete curb (minimum 18" wide)		
17)	Residential Pavement:		
	a. Public: Per current RCOC standards; Minimum 7" concrete over 6" of 21 AA crushed limestone aggregate with 4" mountable curb (minimum 18" wide)		
	b. Private: Minimum 7" bituminous over 6" of 21AA crushed limestone aggregate with 4" mountable concrete curb (minimum 18" wide)		

**V. Paving and Grading (continued)**

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18)	Industrial Pavement:		
	a. Minimum 9" concrete over 6" of 21AA crushed limestone aggregate for main roads & parking areas		
	b. Minimum 9" bituminous over 6" 21AA crushed limestone aggregate for main roads & parking areas		
	c. 6" concrete curb (minimum 18" wide)		
19)	Dumpster Pads: min. 8" concrete (14' x 20') over 6" of 21AA or CL2 Sand		
20)	5' Sidewalks:		
	a. Along existing public R.O.W.s (except section line roads)		
	b. Along both sides of all proposed R.O.W.s (except section line roads)		
	c. Within site as shown on site plan or tentative preliminary plat		
	d. Located 1' inside of right-of-way line		
	e. Cross-section shown: 4" min. concrete, 6" for drive crossings		
	f. Location of all handicap ramps shown & curb drop detail shown		
	g. Drain crossing provided with buffer or bridge		
21)	8' wide bituminous pathway		
	a. Path is shown across the frontage of site along section line roads		
	b. Ramps shown		
	c. City Standard Details shown		
	d. Located 1' inside of right-of-way line		
	e. Path avoids utility poles		
	f. Drain crossings provided with buffer or bridge		
22)	Standard road end treatment and signs at all dead end roads provided		
23)	Subdivision lot grading:		
	a. Reasonable building envelopes/footprints shown for each lot		
	b. Adjacent brick ledges shall be within a 0.5' of each other		
	c. A min. 2% (0.5'), max. 7% (or 1') fall from brick ledge to sideyard high pt. standard lots shall have HP located ≈ 50' from ROW line		
	d. The fall of land away from a building is a min. 0.5' in first 25' and min. 1% (max. 7% ) slope thereafter		
	e. Front and rear side yard elevations provided for lots with brick ledges stepped from front to back (front grades approximately 25' from ROW and rear grades approx. 60-70' from ROW) in a standard lot		
	f. Brick ledge grade between 1.5' – 2.5' above adjacent top of curb		
	g. Min. 0.5% swale slopes provided		
	h. Drainage arrows provided throughout grading plan		

**V. Paving and Grading (continued)**

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24)	Commercial / Industrial grading:		
	a. Drainage arrows provided for all lawn areas		
	b. Min. 0.5%, max. 7% swale slopes provided		
	c. The fall of land away from a building is a min. 0.5' in first 25' and min. 1% max. 7% slope thereafter		
25)	City's Standard Detail Sheet with construction notes for Parking provided if applicable		